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ABSTRACT

This circular provides informatien tc assist in assessing the pollutien pctential of livestcck cperations. It discusses a systematic approach to resclving prcblems thrcugh feedlot runoff control, liquid manure handling, hauling and lagccring, and ditching. (CS)

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Livestock Waste Management In A Quality Environment

SE 023 928

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The definitions given below will help you to understand waste management terms that may be new to you.

Diversion. A channel with a supporting ridge on the lower side constructed across the slope.

Holding Pond. An earthen pond for the collection and temporary storage of polluted runoff from areas having concentrated livestock or other agricultural wastes.

Holding Tank. A fabricated structure for temporary storage of animal wastes and waste water.

Lagoon. An earthen pond for biological stabilization and storage of organic wastes. Lagoons may be described by the type of bacteria that can be supported in them. Aerobic bacteria require free oxygen for their growth, while anaerobic bacteria do not require oxygen. Aerobic lagoons are usually odorless, and anaeorbic lagoons produce objectionable odors.

Oxidation Ditch. A continuous open-channel ditch with an aeration unit to circulate the liquid and supply oxygen to the contents.

Settling Basin. A concrete tank, earth pit, or other facility constructed as part of a feedlot runoff control system to detain contaminated liquid for a sufficient period to permit the solids to settle for later removal.

Utilization Area. An area of cropland for the disposal of animal waste and associated products. A utilization area must be managed in such a manner that the application of wastes will not cause water pollution or damage crops grown on the area.

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To comply with the Illinois Environmental Protection Act, livestock operations must not pollute water or air. Some existing livestock facilities may be so situated that there is little chance that the runoff will pollute water and that the odors are objectionable. But many facilities will need modification, and producers will need to change their method of managing manure.

This circular has been prepared to assist you in assessing the pollution potential of your livestock operation and to provide a systematic approach to resolving problems. It does not incorporate extensive technical data on buildings, manure collection and handling facilities, or equipment. If you would like more specific detailed information on livestock waste management, consult the list of references on page 15. You may also obtain advice and assistance from the county offices of the Cooperative Extension Service, Soil Conservation Service, and the Agricultural Stabilization and Conservation Service.

ANALYZING THE SITUATION

One of the options available for stopping pollution by livestock waste from your farm is to quit raising livestock. There are two important reasons why you may want to consider this option. First, ask yourself if you are physically able or if there is someone else to take over active management of your livestock business so that it can be continued long enough to justify the cost of waste management changes. Second, ask yourself if you can avoid odor complaints from present or future neighbors. The length of time you have been raising livestock in your location has little influence in nuisance claims.

A second option is to continue with the same number of livestock in the same location. To choose this option, you should have a labor-saving system in good repair so that additional expenditures on waste management facilities are justified. You will still want to consider odor control for yourself as well as for your neighbors, but water-pollution control facilities should not increase odor over what it is now for the same number of livestock.

A third option is to continue with the same number of livestock at a new location on the same farm or on another farm. You should consider this option when existing facilities are obsolete and poorly located.

A fourth option is to expand the livestock operation at the same time that you comply with pollution control laws. Expansion invariably means some new facilities. Choosing this option provides an opportunity to phase into a completely different livestock production system at a new location with changes in waste management. If water pollution can be easily controlled at the old facilities, these facilities may be used until they wear out or are obsolete. Odor control is an important consideration before expanding, and it is related, of course, to the location and waste management system that you choose.

There are probably many variations to these four options. The suggestions given here are intended to get you to think through your entire situation before undertaking changes in the waste management system.

PARTS OF A LIVESTOCK WASTE MANAGEMENT SYSTEM

There are five parts to every livestock waste management system: collecting, processing, storing, transporting, and utilizing. These are considered in detail below.

Collecting

Some of the places where manure collects are as follows:

1. The gutter behind a row of stalls.
2. The alley in a free-stall barn.
3. The feedlot or exercise lot.
4. The manure pack in a loafing shed.
5. The tank under slotted floors, at the end of a free-stall alley, or at the edge of a lot.
6. The floor under poultry cages.

The first three collection places listed above require frequent removal of the waste to a processing or storage facility or directly to a field for utilization. The last three also serve for storage.

Processing

Processing means to do something to or with livestock waste that changes its characteristics so as to improve the storing, transporting, or utilizing aspects of a system. Processing includes separating solids from liquid, composting, drying, biological degradation, chemical treatment, and protein production. The following devices are used to process livestock waste:

1. Gutter drains for separation of liquid from solids.
2. Settling tanks for milking parlor waste.
3. Settling basins to settle out solids that are carried in feedlot runoff.
4. Oxidation equipment for aerobic degradation and possible microbial protein production. This might be an oxidation ditch or mechanically aerated lagoon.
5. Lagoons for biological degradation. Since it is usually impractical to make lagoons naturally aerobic, some odor may be expected.
6. Composting facilities. These are seldom used by farm producers.
7. Drying equipment. Experimental work has been mostly with poultry manure.

Storing

Long-term storage facilities are often required because bad weather and field conditions may physically prevent the transportation of manure, the odor released when manure is spread may force delays, or the stage of development of crops may require a producer to continue storage. Under certain weather conditions, application of manure to land may also create potential water pollution. For these reasons, the following long-term storage facilities should be considered: manure stacking structure; manure pack in a loafing shed; holding pond for feedlot runoff; and a tank for liquid manure, including tanks under slotted floors.

Transporting

There are times when manure and waste water have to be moved from storage to the utilization area. Manure must be removed from sheds and stacking areas, manure tanks must be pumped, and holding ponds must be emptied and lagoon levels lowered.

The types of equipment used for transporting wastes are the conventional manure spreader, liquid manure spreader, irrigation equipment, and low-capacity pump and pipe with gravity discharge.

Utilizing

Most livestock waste in Illinois will be utilized on the farm on which it is produced by applying it to fields where crops are grown. There are two good reasons for doing this. First, manure adds nutrients, improves soil tilth, enlarges water-holding capacity, lessens wind and water erosion, increases aeration, and promotes the growth of beneficial soil organisms. Second, there is no economic system that can degrade livestock waste to the extent that the effluent is suitable for discharge to a stream as in municipal waste treatment.

Application to the land must be at a time and in such a manner that the waste is not carried off by rains or melting snows. Spreading waste on frozen, snow-covered, or saturated soils should be avoided, particularly if the land is rolling and extensive runoff is probable.

Soils have varying capacities to accept manure and to serve as a treatment process without polluting underground water or surface runoff. It may be necessary to install terraces, establish buffer strips, or use selected vegetation to provide an acceptable manure-utilization area.

A lagoon could serve as final disposal in some operations if the lagoon does not overflow. It is likely that in Illinois liquid buildup would exceed evaporation, requiring removal of some liquids to the land at certain times.

Another alternative to land application is to sell dried or composted fertilizer. This method has limited application because of technical and marketing problems.

A future possibility is to harvest microbial protein from an oxidation ditch and feed it to livestock. This system has been tried experimentally, and resulted in no effluent leaving the oxidation ditch.

SYSTEMS TO REDUCE WATER POLLUTION

Suggested livestock waste management systems are shown on the following eight pages. Components of one suggested system may be combined with another, and all of the components indicated for each of the drawings are not always required. For example, in a liquid manure system, the irrigation equipment illustrated may not be needed, depending upon the desired type of management. The system most suited for a given operation must be based on a thorough evaluation of all the physical and management factors.

The size and shape of each component for an actual system will depend upon the calculations made for that system. You may obtain detailed information by consulting the references listed on page 15. The information given below will help you in making estimates for preliminary plans. A holding pond should have capacity to receive 15 inches of runoff from a concrete lot, and 12 inches of runoff from a dirt lot. There are about 34 cubic feet in 1 ton of liquid manure, and 1 inch of runoff per acre equals 3,600 cubic feet or 27,000 gallons. To calculate the volume of a rectangular pond with 3:1 side slopes, use the following formula:

Volume = (area of bottom × depth) + (1.5 × depth × depth × distance around bottom)

Example: Volume = (50′ long × 40′ wide × 10′ deep) + (1.5 × 10′ deep × 10′ deep × 180′ around bottom) = 20,000 + 27,000 = 47,000 cubic feet.

	Dairy	Beef	Swine	Poultry	Sheep
Average animal weight, pounds	1,300	1,000	150	4	100
Manure production, pounds per day	100	75	8.5	.25	4
tons per year	18.3	13.7	1.6	.5	.7
Nitrogen content, pounds per year	140	190	26	1	15
Phosphorus content, pounds per year	36	55	15	1	5
Potassium content, pounds per year	113	124	22	.7	15
Liquid manure tank volume (includes waste water and dilution water), cubic feet per animal per day	2	1.5	.3	.006	.1
		(sow with litter or boar)	.7		
Aerobic lagoon, animals per surface area	20	30	140	3,000	180
Anaerobic or aerated lagoon, cubic feet per pound of liveweight	2	2	2	2	2

FEEDLOT RUNOFF CONTROL (UNRESTRICTED SPACE)

This system is adapted to beef, dairy, and swine operations where runoff from feedlots is sufficient to constitute a potential pollution hazard.

① **Feedlot.** Animal wastes will accumulate on the feedlot and in the open shelter. Most of these wastes will be handled as a solid with conventional equipment and applied to the utilization area, but runoff from the lot will transport some solid and liquid waste that must be intercepted.

② **Clean water diversions.** To minimize the amount of runoff that can transport waste, clean water should be diverted from entering areas where wastes are deposited or stored. Diversions may be needed above and adjacent to the feedlot, and buildings should be guttered. The feedlot size may be reduced to the minimum recommended area needed for good animal growth and management.

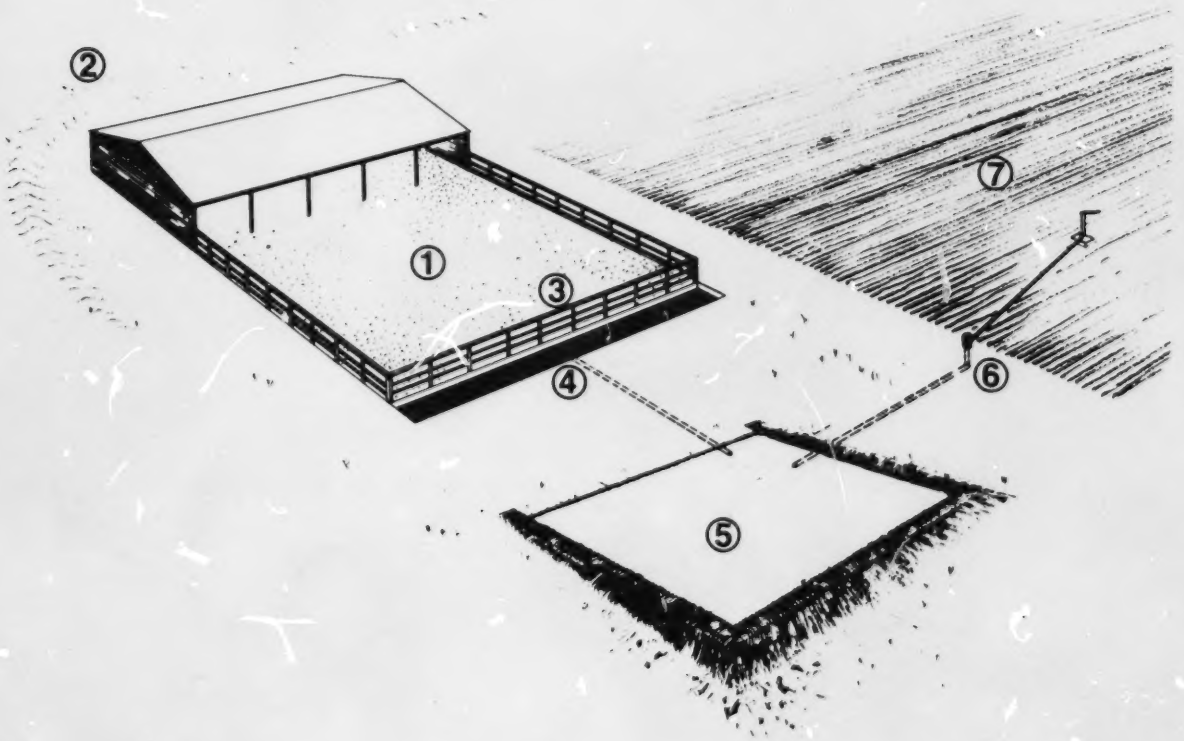
③ **Runoff collection.** The runoff from the feedlot must be collected and directed to a central storage area. This may be accomplished by the natural feedlot slope, or by diversions, gutters, curbing, or pipes.

④ **Settling basin.** A settling basin slows the velocity of runoff so that most of the solids will settle from the runoff water. The basin should be large enough to accumulate the solids that are carried in the runoff for a six-month period. Other solids should not be scraped into the basin. The basin should be shaped to permit cleanout with available equipment. When a tractor loader is used, the bottom of the basin may need to be paved for easy operation.

⑤ **Holding pond.** A holding pond receives the liquid from the settling basin. This pond must be large enough to store the runoff from average precipitation during the period from November through April. It must be emptied after major runoff periods and before winter to provide storage for subsequent runoff.

⑥ **Waste water transport.** A system must be included to transport the stored runoff to its utilization area.

⑦ **Utilization.** Liquids should be applied to the utilization area at times and at rates that will not cause runoff, excessive odors, or damage to crops.



FEEDLOT RUNOFF CONTROL (RESTRICTED SPACE)

Many feedlots are boxed in by buildings, roads, lanes, or waterways so that runoff water may have to be pumped to another area. Or it may be necessary to relocate the livestock operation.

① **Feedlot.** Animal wastes will accumulate on the feedlot and in the open shelter. Most of these wastes will be handled as a solid with conventional equipment and applied to the utilization area, but runoff from the lot will transport some solid and liquid waste that must be intercepted.

② **Clean water diversions.** To minimize the amount of runoff that can transport waste, clean water should be diverted from entering areas where wastes are deposited or stored. Diversions may be needed above and adjacent to the feedlot, and buildings should be guttered. The feedlot size may be reduced to the minimum recommended area needed for good animal growth and management.

③ **Runoff collection.** The runoff from the feedlot must be collected and directed to a central storage area. This may be accomplished by the natural feedlot slope, or by diversions, gutters, curbing, or pipes.

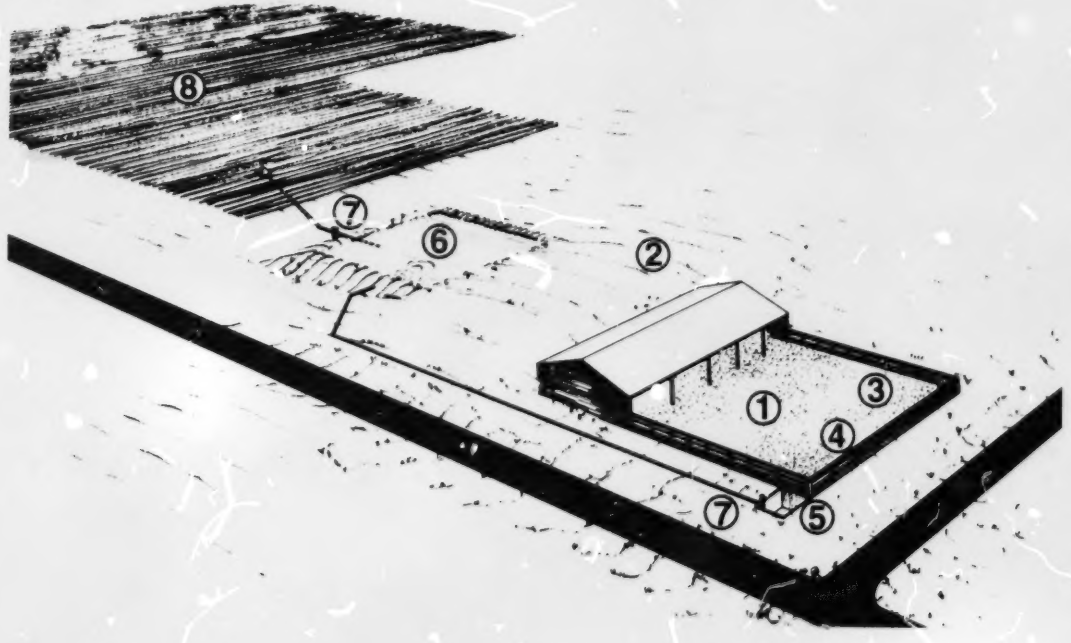
④ **Settling basin.** A portion of the existing lot or a narrow concrete channel along the outside of the lot may serve as a settling basin to slow the velocity of runoff so that most of the solids will settle from the runoff water. The basin should be large enough to accumulate the solids that are carried in the runoff for a six-month period. Other solids should not be scraped into the basin. The basin should be shaped to permit cleanout with available equipment.

⑤ **Sump pit.** A sump pit at the end of the settling basin collects runoff water that is pumped to a place on the farm where space is available to build a holding pond. The sump and pump should be sized to collect and pump water away about as fast as it runs off in the most intense storm.

⑥ **Holding pond.** A holding pond receives the liquid from the settling basin. This pond must be large enough to store the runoff from average precipitation during the period from November through April. It must be emptied after major runoff periods and before winter to provide storage for subsequent runoff.

⑦ **Waste water transport.** A system must be included to transport the stored runoff to its utilization area.

⑧ **Utilization.** Liquids should be applied to the utilization area at times and at rates that will not cause runoff, excessive odors, or damage to crops.



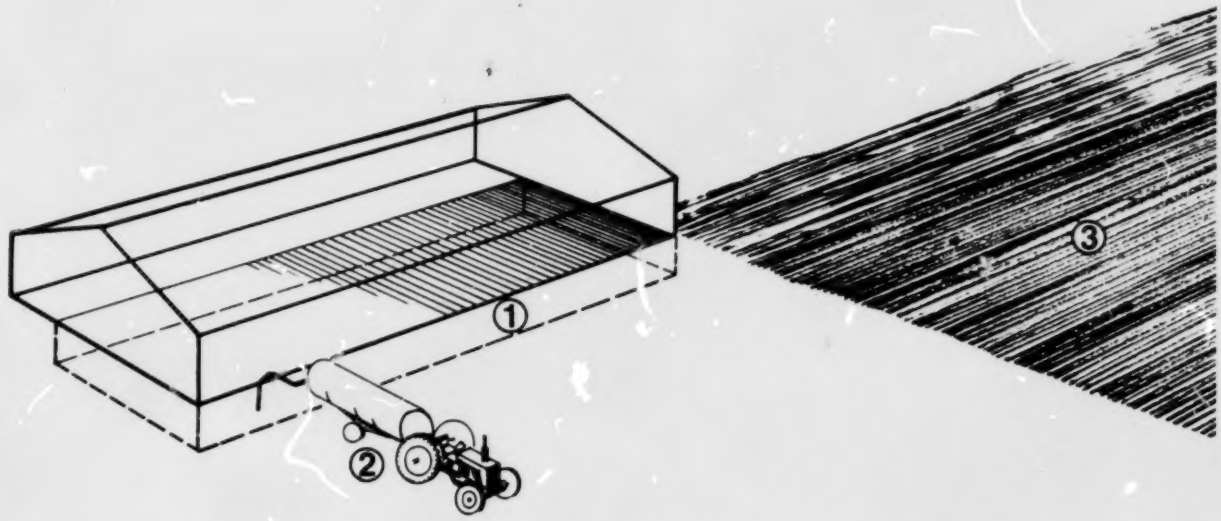
LIQUID MANURE SYSTEM (HAULING)

In this liquid manure system, wastes are collected in tanks, and the tanks are emptied periodically by spreading the contents on a utilization area.

① **Collection.** The collection tank may be under a part or all of the building floor, or it may be outside the building. Tanks under buildings will usually have slotted floors over them, although some dairy manure tanks may have a solid cover with wastes scraped into protected openings. Tanks built outside buildings should be covered to prevent collection of rainwater, odor problems, fly breeding, and safety hazards. The tank should be large enough to hold a 90- to 180-day accumulation of manure and waste water. The most suitable storage period depends upon the type of soil, crops, topography of the utilization area, and the availability of labor.

② **Pumping and hauling.** A pump or vacuum system is used to remove wastes from the collection tank. A liquid manure wagon is needed to transport the wastes to a utilization area. The wastes may be spread on the surface of the land, but direct injection into the soil reduces odor and the chances of surface runoff.

③ **Utilization.** Land must be available on which to apply wastes and utilize the nutrients. The wastes should be applied at times and at rates that will not cause runoff, excessive odors, or damage to crops.



LIQUID MANURE SYSTEM (LAGOONING)

A lagoon may be used as the primary disposal device for some livestock production systems. The decision to use lagoons will be based on the size of the livestock operation, location, terrain, availability of land on which to utilize waste, etc.

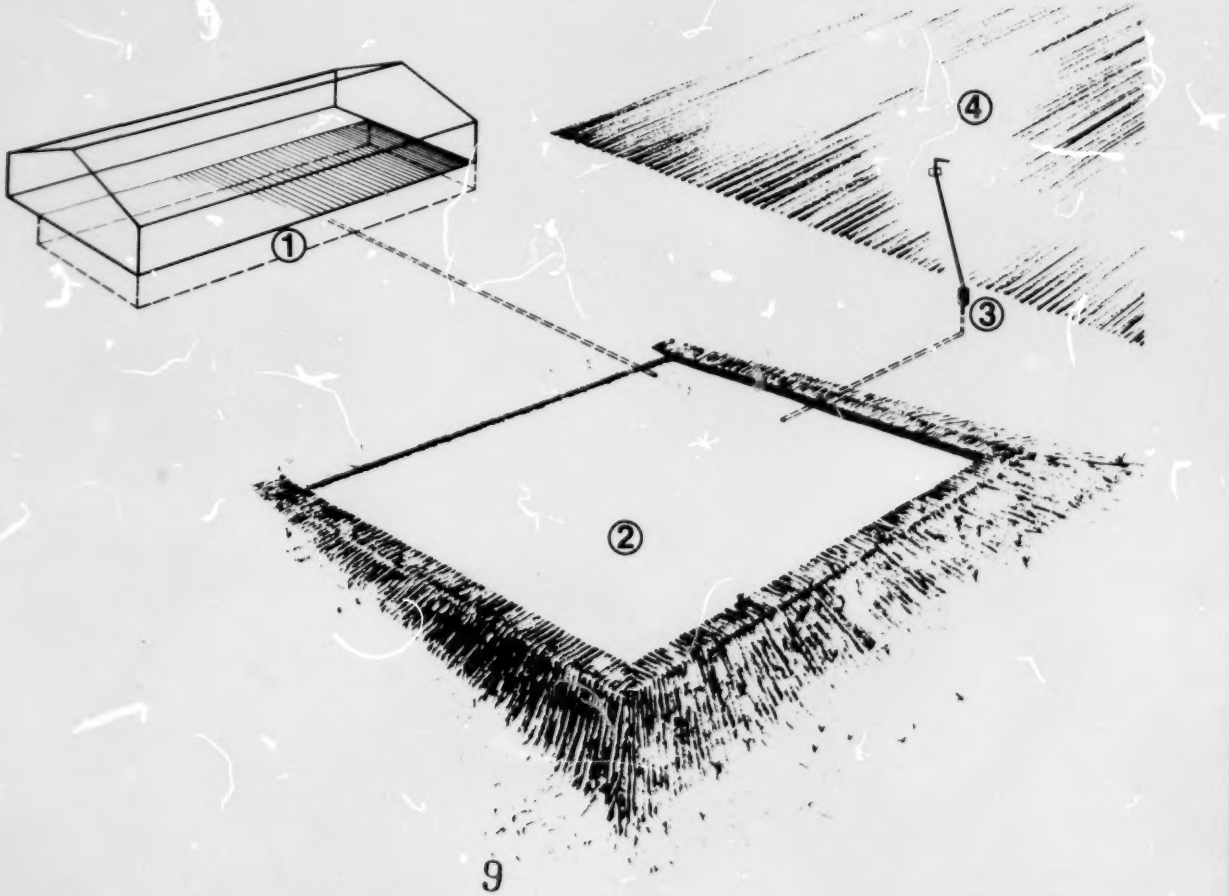
A properly sized anaerobic lagoon could work well for a feeder-pig producer with a relatively small number of sows and litters. An anaerobic lagoon with extra freeboard for storm water might be used to collect dairy lot runoff and the daily wash water from the milking operation. A mechanically aerated lagoon could be designed for any size of livestock operation if the combination of circumstances suggested that lagooning was the best alternative.

① **Collection.** Wastes are collected in a tank or gutter until there is sufficient volume to provide full pipe flow from the collection point to the lagoon when a valve is opened. The valve may be a gate to hold back water at the lower end of a dairy-cow holding area, a plug in the bottom of a tank under slotted floors, or other devices.

② **Lagooning.** A properly sized anaerobic lagoon can be used when some odors can be tolerated. A mechanically aerated lagoon may be used when odor control is important. A naturally aerobic lagoon is usually not feasible for livestock wastes because it requires a large surface area and a large quantity of water. An aerobic lagoon may be suitable for small operations.

③ **Protection against lagoon overflow.** Lagoons must not be allowed to overflow. Sufficient freeboard should be provided to take care of some storm water. The liquid level in the lagoon must be maintained through the use of a pump and pipeline or a tank wagon.

④ **Utilization.** Land must be available on which to apply excessive lagoon liquids at times and at rates that will not cause runoff, excessive odors, or damage to crops.



LIQUID MANURE SYSTEM (HAULING AND LAGOONING)

This liquid manure system includes a collection tank, a tank-wagon manure spreader, and a lagoon that provides flexibility in management.

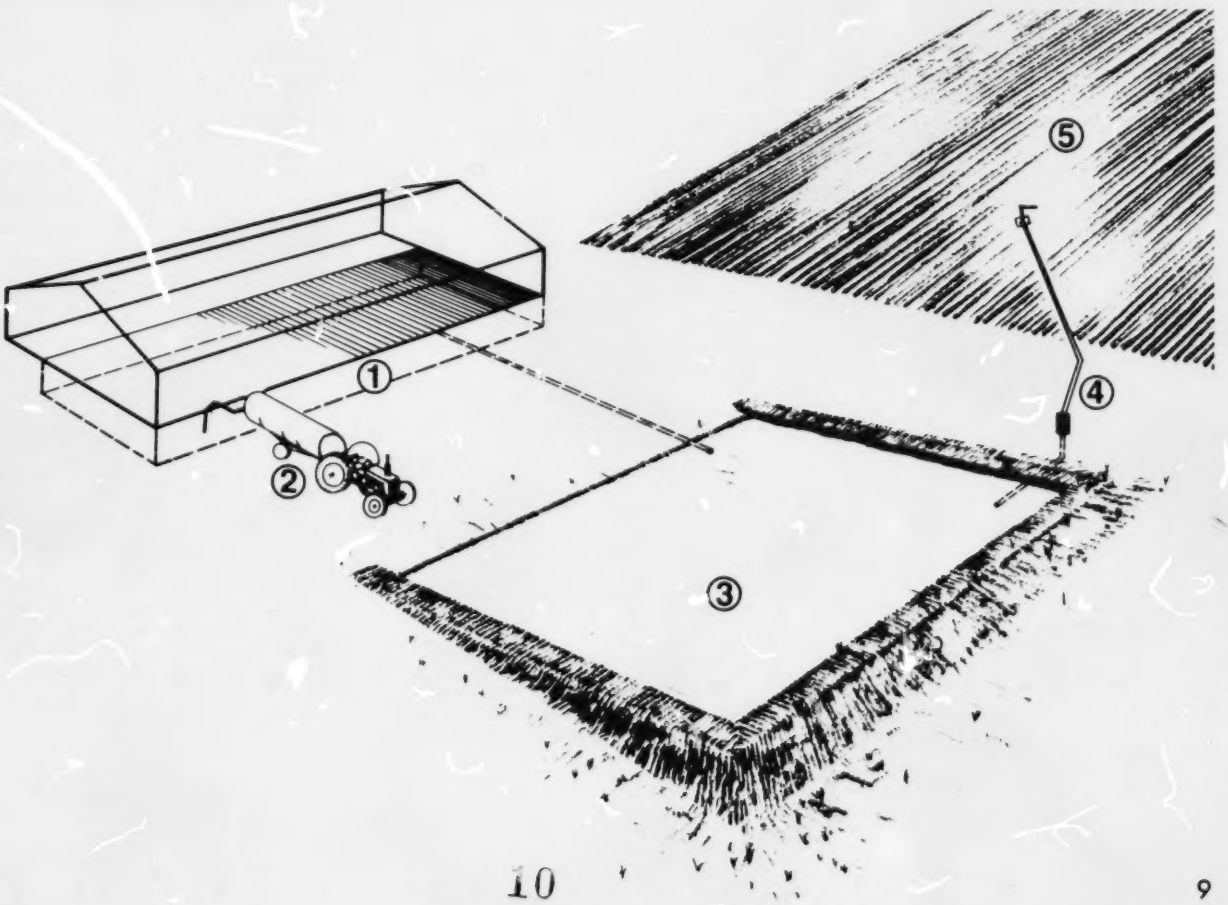
① **Collection.** The collection tank may be under a part or all of the building floor, or it may be outside the building. Tanks under buildings will usually have slotted floors over them, although some dairy manure tanks may have a solid cover with wastes scraped into protected openings. Tanks built outside buildings should be covered to prevent collection of rainwater, odor problems, fly breeding, and safety hazards. The tank should be large enough to hold a 90- to 180-day accumulation of manure and waste water. Liquids from swine manure can be allowed to overflow for several months, and there will still be a pumpable slurry in the tank. This procedure is not suggested for cattle manure.

② **Pumping and hauling.** A pump or vacuum system is used to remove wastes from the collection tank. A liquid manure wagon is needed to transport the wastes to a utilization area. The wastes may be spread on the surface of the land, but direct injection into the soil reduces odor and the chances of surface runoff.

③ **Lagooning.** A lagoon to receive overflow adds flexibility to manure management. When a lagoon does not receive the total waste production, it can be sized to be relatively odor-free.

④ **Protection against lagoon overflow.** Since a lagoon must not be permitted to overflow into a watercourse, a pump and pipeline may be needed to transport excess liquids to a utilization area.

⑤ **Utilization.** The utilization area for excess liquids from a lagoon may be a relatively small area of cropland set aside for this purpose. Land must also be available on which to apply wastes from the collection tank. The waste should be applied at times and at rates that will not cause runoff, excessive odors, or damage to crops.



GUTTER FLUSHING SYSTEM IN CONFINEMENT BUILDING

A type of system being used in a few cases is one in which manure is flushed from a confinement building to a lagoon or tank. In Illinois, this system is best adapted to swine farrowing houses or nursery buildings. In some free-stall dairy operations, however, waste collected in alleys can be flushed with water collected from cow washing.

① **Collection.** Wastes are deposited in gutters or alleys that are sloped for drainage.

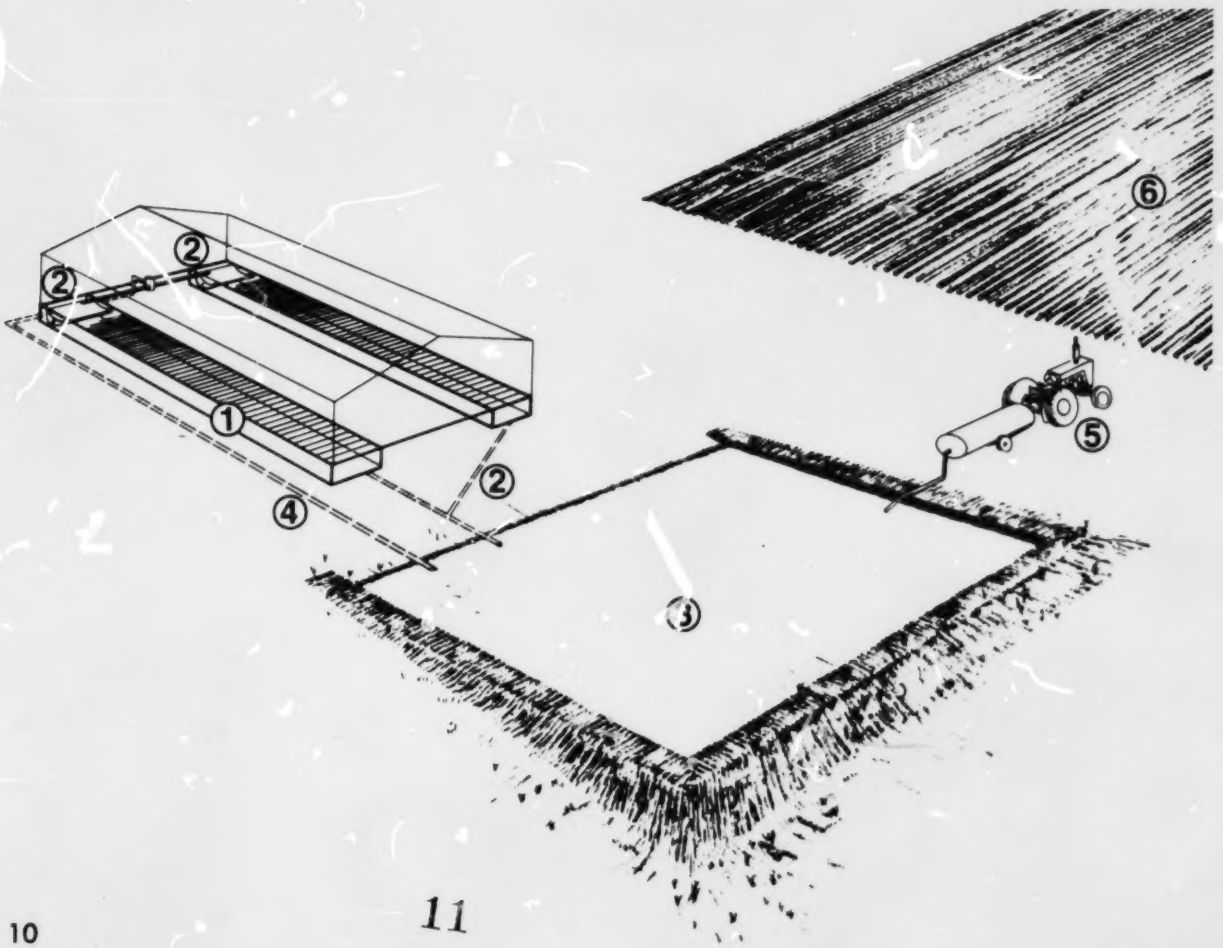
② **Flushing.** A tank is filled with water and dumped periodically to flush waste from the building.

③ **Storage and treatment.** Waste may go to an aerated lagoon or, in some small operations, to a holding tank that can be pumped and the waste applied to cropland.

④ **Water reuse.** Water from the lagoon may be used to refill the flushing tanks.

⑤ **Protection against lagoon overflow.** To keep the lagoon from overflowing, equipment may be needed to haul or pump some excess liquid to a utilization area. A pump and pipeline or a tank wagon may be used for this purpose. Recycling some water for flushing the gutters or alleys in the building should minimize the problem of lagoon overflow. For this reason, equipment can be relatively small and perhaps not permanently installed.

⑥ **Utilization.** The utilization area for excess liquids may be a relatively small area of cropland set aside for this purpose. The waste water should be applied at times and at rates that will not cause runoff, excessive odors, or damage to crops.



OXIDATION-DITCH SYSTEM IN CONFINEMENT BUILDING

The in-the-building oxidation ditch is a method of reducing odors when there is pressure from urban areas. This system can also lower labor requirements, decrease the volume of solids, and reduce the pollution potential of the manure.

① **Collection.** The ditch is a shallow tank shaped like a racetrack so that the contents can be circulated continuously. Waste drops into the ditch through slotted floors.

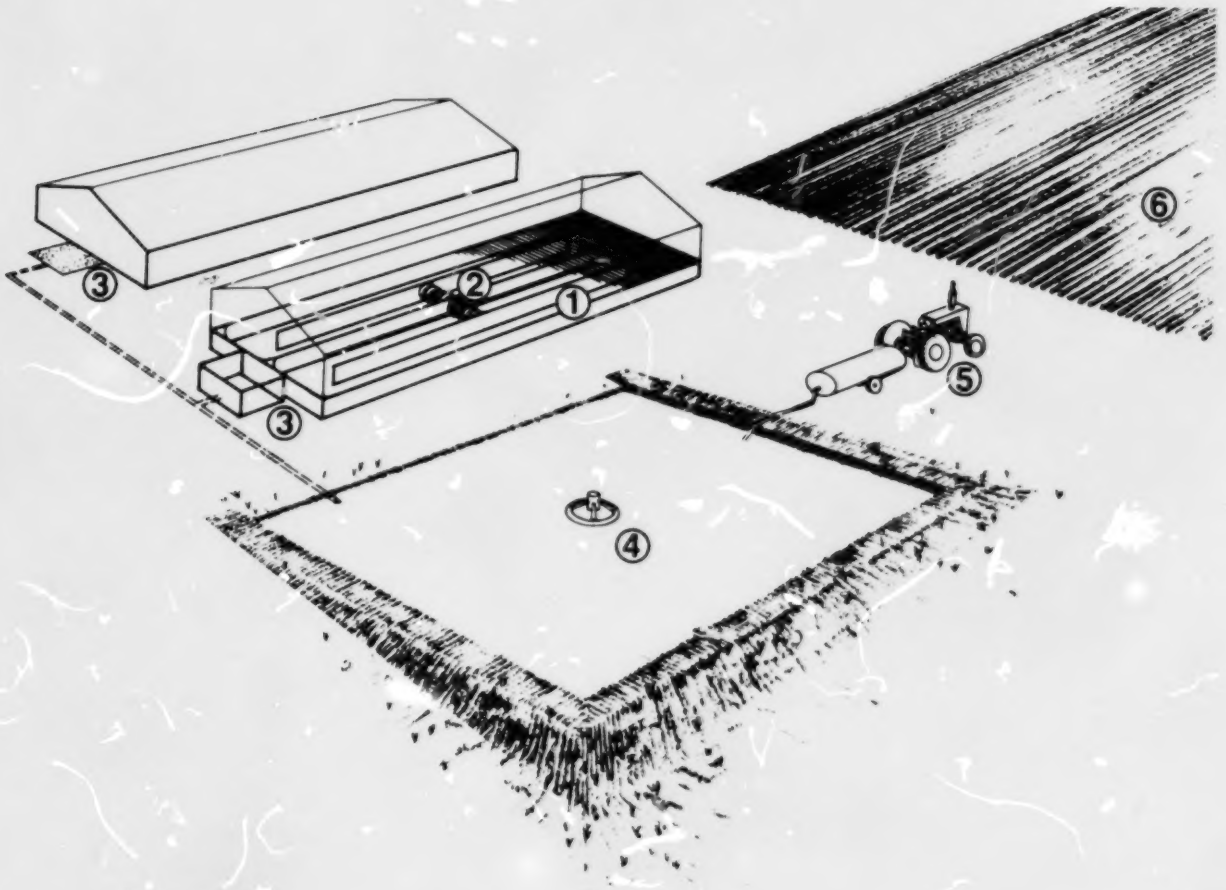
② **Aeration.** The circulating device may be a rotor similar to a paddle wheel, or it may be a propeller unit that adds oxygen to the waste. Several manufacturers have this kind of equipment on the market. Since the equipment has been field-tested and improved, one can expect reliability with proper management.

③ **Sludge trap.** A sludge trap is a small chamber to receive overflow and settle sludge.

④ **Ditch overflow.** Excess waste water can be routed to a large tank or aerobic (naturally or mechanically aerated) lagoon. The volume of waste water is usually not large because of evaporation at the rotor. Odors can be controlled because the waste water is partially treated, but it is not adequately treated for direct discharge to a watercourse.

⑤ **Protection against lagoon overflow.** To keep the lagoon from overflowing, equipment may be needed to haul or pump some excess liquid to a utilization area. A pump and pipeline or a tank wagon may be used for this purpose.

⑥ **Utilization.** The utilization area for excess liquids may be a relatively small area of cropland set aside for this purpose. The waste water should be applied at times and at rates that will not cause runoff, excessive odors, or damage to crops.



SOLID AND LIQUID SYSTEM FOR DAIRY FACILITIES

Waste from a stanchion dairy barn may be stored in a manure stacking facility, and waste in a loose-housing barn may be allowed to accumulate in a manure pack. Liquids that drain from these wastes must be collected, and the milking parlor and milkhouse wastes must also be properly disposed of.

① **Collection.** The barn may be equipped with a gutter cleaner, or waste may be scraped, using small tractors. Bedding is used to absorb urine and keep the livestock comfortable and clean.

② **Stacking.** When daily spreading of manure is impractical, the waste can be stacked in a properly planned area. Adequate storage space should be provided for the anticipated volume of waste that may accumulate in a 180-day period. This area may be covered to minimize the liquid-handling problem and fly breeding.

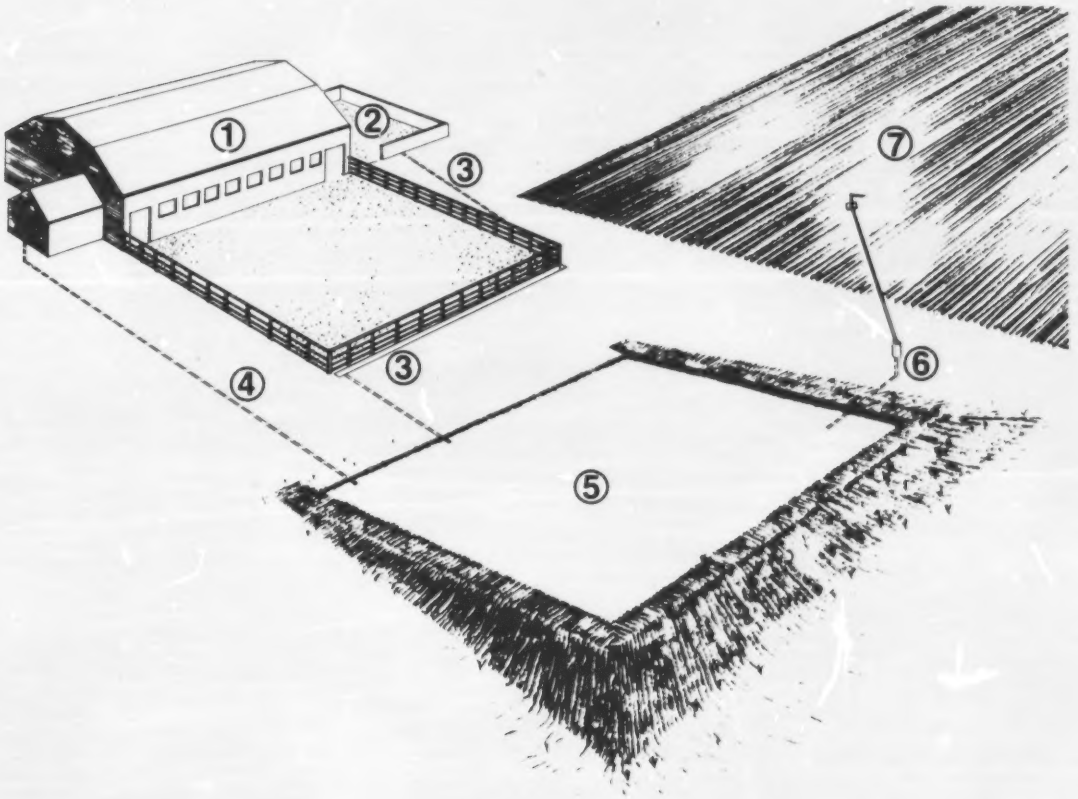
③ **Lot runoff.** A system must be provided to collect the seepage and runoff from the manure stack and the cow lot next to the barn.

④ **Milking parlor wastes.** When a milking parlor is a part of the system, large volumes of waste and water from this facility may need to be included in the liquid-handling system. Whenever possible, these liquids should be combined with those from the stacking operation and any contaminated runoff from outside feedlots, and delivered to a lagoon sized for the anticipated amount of waste.

⑤ **Lagooning.** A tank or lagoon may be used to store the liquid that drains from the stacking area, exercise lot, and milking parlor. This storage facility must be large enough to contain the anticipated liquid that may be delivered during a 180-day period.

⑥ **Protection against lagoon overflow.** Lagoons must not be allowed to overflow. Sufficient freeboard should be provided to take care of some storm water, and the lagoon must be pumped down as necessary. A pump and pipeline or a tank wagon may be used for this purpose.

⑦ **Utilization.** Land must be available on which to apply waste water at times and at rates that will not cause runoff, excessive odors, or damage to crops.



SUGGESTIONS TO REDUCE ODOR

No livestock enterprise can be completely odor free, but a favorable location, a well-planned waste management system, and careful management of that system will help minimize odor. Unfortunately, a substantial increase in the number of animals in a given situation may turn a tolerable odor level into an intolerable one. In other words, a low-odor system of livestock waste management may still result in complaints if you have a large number of animals. Odor control is not an exact science. It depends considerably on human judgment and tolerance.

Controlling undesirable odors from livestock wastes has become a major concern in the development of new and larger livestock units. These objectionable odors may limit the location and ultimate size of future livestock units.

In some instances, neighbors have objected to odors from livestock wastes by filing suit in a civil court, and have been awarded damages based on the fact that these odors interfered with their normal living pattern. In addition, objectionable odors make it difficult to employ extra help or to interest your own family in the livestock operation.

Odor is a *personal* response to gas substances in the air. There is no precise instrument for accurately measuring the intensity of a particular odor and the reaction of people to that odor. Although people vary both in their sensitivity and response to specific gases in the air, there is sufficient agreement among people that certain odors are offensive to warrant taking appropriate measures to minimize the formation of these odors.

Odorous gases are produced from anaerobic decomposition of livestock manure. Anaerobic decomposition occurs in the absence of oxygen, such as in pits beneath slotted floors, in manure packs in solid-floor buildings, or in moist manure accumulations on open lots. Among the gases produced are carbon dioxide, methane, ammonia, and hydrogen sulfide. The last two have rather characteristic and, to most of us, offensive odors. Additional compounds produced in trace amounts are amines and mercaptans. Although amines and mercaptans are present only in very low concentrations, their odors are detectable in concentrations well below that of ammonia and hydrogen sulfide.

It is not economically feasible for livestock producers to eliminate odor completely, even though treatment facilities could be designed for near zero odor. There are, however, certain guidelines that can be followed to reduce objectionable odors and minimize complaints from neighbors.

Locate Livestock Unit Wisely

Proper selection of a site on which to locate a livestock unit is vital, particularly when building new facilities or expanding existing ones. Do not assume that because you own the land you can do with it as you please.

Select a site that is remote from residences and commercial development. New buildings should be constructed far enough away from main highways and thoroughfares so that their appearance and odor will not be objectionable to passersby. Locate the livestock unit so that the prevailing winds do not carry odors to your residence or to close neighbors downwind.

Pay particular attention to location when remodeling existing buildings. Do not remodel a building even for a small livestock unit if it is poorly located. Once power, water, feed storage, and other necessary facilities are provided for an enterprise, it becomes the nucleus for all further expansion. What once was planned as a rather small enterprise may soon grow to appreciable size, and then cause major problems if it is poorly located.

Provide Good Housekeeping

Good housekeeping around your livestock unit and around the entire farmstead will help to minimize odors, and will let your neighbors know that you are concerned with preserving the environment.

Keep the feedlots and pen floors as clean as possible. Good pen arrangement and management can change the dunging habits of livestock and help keep the pens clean. When bedding is used, keep it dry to prevent the creation of conditions favorable to odor production. Areas likely to be wetted should drain and dry quickly, or new bedding material should be applied to absorb the liquid. Regular cleaning will help reduce odors. If manure must be stored for certain periods, use plantings or solid fencing to screen it from view. Keep weeds mowed and junk picked up.

Use Good Judgment When Hauling Wastes

Most odor complaints arise when manure is hauled and spread on the land. Schedule cleaning and hauling at times when it will be least offensive to neighbors. Do not haul on still days with high humidity. Avoid twilight hours with no breeze. Do not haul in fields next to your neighbor's dwelling. Pay attention to wind direction so that the odors are not carried to the neighbors' farmsteads. Avoid times when you know that your neighbor has guests.

When hauling liquid wastes, maintain sufficient water in the pits to keep all solids submerged. Water absorbs

ammonia and helps reduce odors. Agitate as little as possible to minimize the release of odorous gases. Cattle wastes must be agitated to work the solids into the slurry, but agitation is not necessary for most liquid swine manure.

Incorporate livestock manure into the soil by placing the waste in a furrow and plowing it under, by spreading the waste on the land and immediately discing it under, or, in the case of liquid manure, by using a tank wagon with chisel attachments so that the wastes are put directly underground. Incorporating the wastes directly into the ground is not only very effective in controlling odors but it also reduces the chances of polluting runoff. This method results in more efficient utilization of the plant nutrients for crop production by reducing losses. When handling waste during periods other than when the ground is frozen, serious consideration should be given to using one of these methods of incorporating the wastes into the ground.

Consider Aerobic Treatment of Wastes

Aerobic treatment of livestock wastes is free of objectionable odor. Aerobic bacteria require free oxygen to decompose organic solids, to destroy most pathogenic organisms, and to reduce the pollutional characteristics of waste by lowering the oxygen demand. They also concentrate the minerals so that they are more easily applied to the land.

The major methods for aerobically treating livestock wastes are the oxidation ditch, the mechanically aerated lagoon, and the naturally aerobic oxidation pond.

The main purpose of treating municipal waste is to reduce the amounts of suspended solids, bacteria, and oxygen-demanding material to an acceptable level for discharging the waste water into streams and lakes. It is not economically feasible, however, to produce an acceptable effluent from livestock wastes. Odor control is the main objective for providing aerobic treatment of livestock wastes.

Investigate Use of Odor Control Chemicals

Several chemicals are on the market for the control and abatement of odors. Some of these chemicals are designed to stop bacterial decomposition and serve as sanitizing agents; others are designed to react with the odorous gases or to keep them from escaping from the manure pit or lagoon. Still others are designed as masking agents that superimpose a pleasant fragrance in the air.

Because of the complex nature of odors and the fact that people respond in highly variable ways, it has not been possible to develop entirely satisfactory means of controlling odors through the use of chemicals. When an odor problem exists, you may want to experiment with odor control chemicals. This experimentation should be carried out in strict accordance with the recommended directions of the manufacturer.

DEAD ANIMAL DISPOSAL

Disposal of the carcasses of dead animals or poultry is of concern not only in relation to pollution, but also in relation to animal disease control and eradication. The Illinois act regarding disposal of dead animals (Illinois Revised Statutes, Chapter 8, paragraphs 149-167) specifies that it is the responsibility of the owner to dispose of the carcass of any dead animal, poultry or fish, and that this disposal shall be within 24 hours by burning, burying, or release to a person operating a truck under permit to dispose of livestock carcasses.

Burning

Standards of the Illinois Environmental Protection Agency prohibit the burning of animal carcasses, except in an incinerator that meets specifications of the Agency. An approved incinator for small carcasses (poultry or baby pigs) can cost up to several thousand dollars.

Burying

The Illinois Enviornmental Protection Agency permits the burial of animal carcasses provided that (1) burial is in a location where runoff will not contaminate water supplies; (2) burial is at a shallow depth so as to avoid contamination of subterranean water; (3) lime or other chemicals that would delay natural bacterial decomposition are not applied to the carcass (the abdominal cavity should be punctured to permit escape of putrefactive gases); and (4) precautions are taken to keep scavenger animals from disturbing the carcass after burial (that is, the burial site must be fenced or covered).

Disposal Pit

A disposal pit may be used in disposing of small carcasses (poultry or baby pigs) provided that the same precautions are taken as required for disposal by burial; and that each carcass is covered with soil at the time of disposal.

Dead Animal Collection Service

The dead animal disposal agent is a valuable serviceman with whom the livestock owner should be personally acquainted, if possible. The livestock owner should keep the name, address, and telephone number of the dead

animal collection service handy, and should be familiar with the fees. When he calls the service, he should give the exact location of the carcass to be collected.

During the 1940's and early 1950's, the livestock population and the value of animal byproducts in Illinois made it profitable for renderers to pay a fee for animal carcasses and provide free pickup. In recent years, however, the decline in value of hides and animal byproducts, together with the increased cost of operating dead animal collection vehicles, have reversed the economics of the situation so that it is now necessary for collection services to charge the livestock owner a fee. Because it has not been as profitable to collect dead animals, the availability of dead animal disposal service in Illinois has been drastically reduced.

If the current trend continues, commercial dead animal collection vehicles will be in operation only in areas of dense livestock population. Should this situation occur, some new means of providing for dead animal collection and disposal will be necessary.

If privately operated dead animal collection service is not available in your area, you should consider forming an organization to finance and operate a dead animal collection truck in a one- or two-county area, possibly on an annual subscription basis.

Dead animal collection vehicles are operated under permit issued from the Division of Meat, Poultry, and Livestock Inspection, Illinois Department of Agriculture, State Fairgrounds, Springfield, Illinois 62706. This Division will give information and assistance in organizing a dead animal collection service. It will also provide specifications for the collection vehicle and operating procedures.

REFERENCES

Unless otherwise indicated, the publications listed below may be obtained from the Department of Agricultural Engineering, College of Agriculture, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801.

General Information

Farm Animal-Waste Management. North Central Regional Publication 206.

Gases from Stored Swine Wastes. AEng.-879.

Guidelines for Pork Producers for Use to Preserve Environmental Quality. (Available from National Pork Producers Council, 3101 Ingersoll Avenue, Des Moines, Iowa 50312.)

Collecting

Beef Housing and Equipment Handbook. MWPS-6. ($1.00)

Dairy Housing and Equipment Handbook. MWPS-7. ($2.00)

Liquid Manure Tanks. MWPS Plan 74303. ($1.00)

Slotted Floors. AEng.-875.

Swine Handbook: Housing and Equipment. MWPS-8. ($2.00)

Processing

Aerobic Treatment of Livestock Wastes. Bulletin 737. (Available from Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.)

Anaerobic Manure Lagoons. AED-1.

Milking parlor wastes (see MWPS-7 listed above).

Oxidation Ditch for Treating Hog Wastes. AED-14.

Settling basin (see MWPS-8 listed above).

Storing

Gases from Stored Swine Wastes. AEng.-879.

Holding ponds (see MWPS-6 and MWPS-8 listed above).

Liquid Manure Tanks. MWPS Plan 74303. ($1.00)

Solid manure storage, holding ponds (see MWPS-7 listed above).

Transporting

The Missouri Approach to Animal Waste Management (Irrigation). (Available from Extension Division, University of Missouri, Columbia, Missouri.) ($1.00)

Utilizing

Farm Animal-Waste Management. North Central Regional Publication 206. (Contains information on fertilizer value, refeeding, composting, drying, etc.)

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